CHAPTER 5. FUTURE WITHOUT-ACTION TRENDS

> ***...about one of every eight U.S. residents now lives in California. During the time period...1995 to 2020...California's population is forecast to increase by more than 15 million people, the equivalent of adding the present populations of Arizona, Nevada, Oregon, Idaho, Montana, Wyoming, New Mexico, and Utah to California...*** (DWR, Bulletin 160-98)

This section describes major trends that could shape future conditions in the Comprehensive Study area. The projected population growth appears to drive other key trends in water use and land use. These trends may in turn affect ecosystem structure and function and flood management infrastructure, operations, and maintenance.

The discussion of future without action trends differs from other parts of this report because it includes a detailed discussion of the Tulare Lake basin. The Tulare Lake basin is placed outside the problem identification area because runoff in this basin rarely affects San Joaquin River flood problems. However, the basin is included in the discussion of trends because future conditions in the Tulare Lake basin could affect San Joaquin River solutions.

Prior to the construction of dams on its major tributaries, the Tulare Lake basin filled during large floods and flowed into the San Joaquin River. Although the Kings River is in the Tulare Lake basin, the North Fork of the Kings River drains into both the San Joaquin River and Tulare Lake. The Tulare Lake basin is further interconnected with the San Joaquin River basin because excess flood waters released from Friant Dam have historically been conveyed through the Friant Kern Canal for use in the Tulare Lake basin.

ECOSYSTEM STRUCTURE AND PROCESS

Over the past one hundred and fifty years, Californians have greatly modified the Sacramento and San Joaquin Rivers and their floodplains. These modifications have included conversion of floodplain areas to agriculture and other uses, modification of river flows and sediment transport for irrigation and flood management, and restriction of river migration. Introduction of exotic plants and animals and harvest of native plants and animals have also significantly affected ecological resources.

The past modifications and practices have caused extensive loss of habitat area, structure, diversity, and functions. The current ecological system is fragmented, stressed, and artificial. Continued population growth will increase stresses on the State's ecological resources.

Numerous programs are underway to restore ecosystem structure and function. The CALFED program and CVPIA are the largest programs promoting restoration. Many other federal, State, and local agencies and non-governmental organizations are also working to

promote ecosystem restoration through an adaptive management approach that increase the likelihood that recent historic trends in ecosystem decline will be reversed. Future design and operation of flood management systems will be a fundamental factor in achieving healthy riverine and floodplain ecosystems.

LAND USE

Urban, agricultural, and environmental water use are shaped by land use patterns and planning. Patterns of future development and water use trends are dictated by city and county land use decisions. Urbanization of agricultural lands, open space preservation policies, habitat creation, and wetlands preservation policies are examples of land use-related decisions that have water use implications. The California Department of Finance (DOF) projects that California's population will increase by more than 15 million by 2020. The San Joaquin Valley is among those areas projected to have high growth rates, with urbanization replacing irrigated agricultural acreage.

Local open space preservation goals can affect the extent of land use conversion. For example, Williamson Act contracts are a common means used to discourage conversion of agricultural land use. Agricultural land retirement programs influence land use trends. For example, the CVPIA authorized the Department of Interior to implement a program for lands receiving CVP water. By November 1997, the Bureau of Reclamation had made one purchase of 600 acres, but its solicitation of proposals from landowners elicited offers to sell over 31,000 acres of land. CVPIA Section 3406(d)(2) directs the Bureau of Reclamation to attain Refuge Level 4 (optimum management supplies) for existing and Action Plan (Kesterson Mitigation) lands by 2002. Some areas have reached Level 4, and others are still on schedule to meet the water supply level by 2002. Planned additions to refuges are occurring on an as-available basis, dependent upon funding. CVPIA Section 3406(b)(22), seasonal agricultural flooding program, has expanded available water bird habitat by tens of thousands of acres, and this program is expected to continue.

Development restrictions contained in the NFIP's insurance and floodplain mapping and The Reclamation Board's designated floodway program will continue to be important factors controlling development of floodplain areas as more communities enter the programs and the agencies develop more flood hazard information. After the 1997 floods, the State accelerated floodplain mapping in the Comprehensive Study area to provide more information for land use decisions.

California's agricultural products compete with products from other regions in the global economy. World-wide trade policies and market conditions far beyond the State's boundaries affect these products. DOF projects significant conversion of agricultural land to urban in the San Joaquin Valley due to projected population increases. This conversion may shift agricultural development onto lands presently used as non-irrigated pasture or to poorer quality soil on hilly

lands adjoining the valley floor, and also cause a consequent shift in crop types and irrigation practices. DWR's Bulletin 160-98 forecasts for 2020 that row and field crops will decline while truck crops and permanent crops will increase. The CALFED program may also promote conversion of irrigated agricultural lands to wildlife habitat. However, even if CALFED changes land use patterns, the change may not cause a net loss of agricultural lands since farmers may shift agricultural operations to other lands that are not currently farmed.

SACRAMENTO RIVER BASIN

In the Sacramento River basin, DOF projects most of the population growth to occur in the southern portion of the basin, primarily Sacramento, Placer, El Dorado, Sutter, Yolo, and Solano Counties. DOF projects significant population growth for the Sacramento metropolitan area and surrounding communities and the Yuba City-Marysville area in Sutter and Yuba Counties. The region includes extensive irrigated agricultural acreage. Rice, irrigated pasture, alfalfa, grain, fruits, nuts, and tomatoes account for about 80 percent of the irrigated crop acreage. However, despite population growth, irrigated acreage in the region is expected to change little during the period through 2020, as shown in Table 5-1.

TABLE 5-1
POPULATION AND CROP ACREAGE -
SACRAMENTO RIVER BASIN

Year	Population (thousands)	Irrigated Crop Acreage (thousands of acres)
1995	2,372	2,139
2020	3,813	2,150

SAN JOAQUIN RIVER BASIN

The principal population centers in the San Joaquin River basin are the Cities of Lodi, Stockton, Tracy, Modesto, Turlock, Merced, and Madera. The northwest part of the area, including Tracy and surrounding communities, is growing rapid as workers in the San Francisco Bay area purchase the Valley's affordable housing. DWR's Bulletin 160-98 forecasts that irrigated crop acreage in the area will decline due to urban development on agricultural lands.

The primary crops in the San Joaquin basin are alfalfa, corn, cotton, deciduous fruit and nuts, grain, grapes, and pasture. The area has many wildlife refuge and wetland areas which are important wintering ground for migratory waterfowl and shorebirds on the Pacific Flyway. About 40,700 acres of the wetlands in the area are privately owned. Table 5-2 shows population and agricultural land use information for the basin.

TABLE 5-2
POPULATION AND CROP ACREAGE -
SAN JOAQUIN RIVER BASIN

Year	Population (thousands)	Irrigated Crop Acreage (thousands of acres)
1995	1,592	2,005
2020	3,025	1,935

TULARE LAKE BASIN

Most of the land on the valley floor in the Tulare Lake basin which is not devoted to urban or industrial purposes is used for agriculture. The dominant crop is cotton, followed by permanent orchards and vineyards. Major orchard crops are almonds and pistachios. Other major crops are alfalfa and pasture, grain, corn, and field and truck crops. Rapidly growing cities in the region include Fresno, Bakersfield, and Visalia. Other population centers include Hanford, Clovis, Tulare, Porterville, and Delano. The Tulare, Buena Vista, and Kern Lakebeds, once the drainage sinks in the basin have been converted to agricultural use. As shown on in Table 5-3, the DOF predicts that population of this basin will increase by 90 percent; while DWR predicts that the basin's irrigated acreage will decline by about 5 percent.

TABLE 5-3
POPULATION AND CROP ACREAGE
TULARE LAKE BASIN

Year	Population (thousands)	Irrigated Crop Acreage (thousands of acres)
1995	1,738	3,127
2020	3,296	2,985

DEMOGRAPHICS

Projections of future population and its geographic distribution described herein are derived from DWR Bulletin 160-98, California Water Plan Update, published in November 1998. This bulletin is updated every five years, and uses California Department of Finance population projections. The DOF uses census data to project base and future year populations for each county in the State. State policy requires that all State agencies use DOF population projections for planning, funding, and policy making activities.

California's annual growth rate was 2 to 3 percent throughout the 1980's. After 1990, the rate slowed to 1.3 percent and the State's population grew by only 2 million. The 1995 population was 32.1 million. Between 1990 and 1994, California lost more than 700,000 jobs due to an economic recession. This job loss promoted a net migration of California residents to other states. However, by 1996, California's economy had improved and replaced the jobs lost during the recession.

Population figures for years 1995 to 2020 were developed for hydrologic basins by DWR using DOF's county population projections. Factors used in distributing the population on a watershed basis included population projections by cities, counties, and local councils of governments. The resulting 1995 population for the Sacramento River basin was 2,372,000, and the 2020 projection 3,813,000; the 1995 population for the San Joaquin River basin was 1,592,000, and the 2020 projection was 3,025,000; the 1995 population for Tulare Lake basin was 1,738,000, and the 2020 projection was 3,296,000. The combined San Joaquin River and Tulare Lake basin population for 1995 was 3,330,000, and the 2020 projection is 6,321,000. The population of the entire state in 1995 was 32,060,000, and the 2020 projection is 47,510,000.

WATER DEMAND AND SUPPLY

Water demand and supply for the Sacramento and San Joaquin River basins cannot be separated from the overall water demand and supply analyses for California as a whole. Urban and agricultural water supplies from these basins are transported out of the basins to the Tulare Lake basin, highly urbanized areas north and south of San Francisco, the central coastal area, and the southern coastal area from Los Angeles through San Diego.

DWR's Bulletin 160-98 assesses California's agricultural, environmental, and urban water needs and evaluates water supplies, in order to quantify the gap between future water demands and water supplies. Much of the bulletin is devoted to identifying and analyzing options for improving water supply reliability. This section is based on information extracted from Bulletin 160-98. Table 5-4 provides a summary of key population, land, and water use statistics.

TABLE 5-4
SUMMARY OF STATISTICS

Statistic	1995	2020	Change
Population (million)	32.1	47.5	+15.4
Irrigated crops (million acres)	9.5	9.2	- 0.3
Urban water use (maf)	8.8	12.0	+3.2
Agricultural water use (maf)	33.8	31.5	-2.3

As Table 5-4 shows, the DOF expects State population to increase to 47.5 million, with 46 percent of the increase in the South Coast. DWR expects irrigated crop acreage by 2020 is expected to decline by 325,000 acres from the 1995 level of 9.5 million acres. Improved water use efficiency combined with reductions in irrigated acreage are expected to reduce average year agricultural water demand by about 2.3 million-acre-feet (maf) by 2020. The largest future shortages are forecast for the Tulare Lake (which is hydraulically connected to the San Joaquin River basin) and South Coast regions, areas that depend heavily on imported water supplies.

Average and drought year water needs for environmental use are forecast to increase by about 0.1 maf by 2020. The North Coast wild and scenic rivers constitutes the greatest component of environmental water demand. Implementation of the CVPIA, Bay-Delta requirements, new ESA restrictions, and Federal Energy Regulatory Commission re-licensing could also significantly modify environmental demands.

Table 5-5 shows the State's estimated water supply for average and drought years under the 1995 and 2020 levels of development with existing facilities and programs. To develop 2020-level conditions, Bulletin 160-98 assumed that present conditions -- facilities, programs, water use patterns, and other factors-- are an adequate basis for predicting the future. However, water supply uncertainties associated with ongoing programs or regulatory actions such as the CALFED Bay-Delta program, Federal Energy Regulatory Commission hydroelectric plant relicensing, and ESA listings may affect the present conditions that are the basis for the water supply projections.

Table 5-6 summarizes the California Water Budget with existing facilities and programs. The water budget shown in Table 5-6 does not account for the State's entire water supply and use. Less than one-third of the State's precipitation is quantified in the water budgets. While precipitation provides California with nearly 200 maf of total water supply in average years, about 65 percent of this supply is depleted through evaporation and transpiration and therefore is excluded from the water supply and water use calculations. The remaining 35 percent is runoff and remains in the State's hydrologic system.

Over 30 percent of the available runoff flows into the Pacific Ocean or other salt sinks and is not available for urban, agricultural, or environmental uses. Available water supplies are computed as the amount of water from any source employed to meet the demand of the users. Water budgets are developed from "normalized" water supply, land use, and water use data which allows definition of an existing level of development that is compatible with a forecasted level of development. Supply projections normalize water project delivery values by averaging historical hydrologic and delivery data. Demand projections normalize base year urban per capita water use data to account for factors such as residual effects of droughts, and variations in urban landscape and agricultural requirements that vary with precipitation, temperature and other factors.

TABLE 5-5
CALIFORNIA WATER SUPPLIES FROM EXISTING FACILITIES AND PROGRAMS

Supply Source	Supply (thousands of acre-feet)			
	1995		2020	
	Average Year	Drought Year	Average Year	Drought Year
Surface Water				
Central Valley Project	7,004	4,821	7,347	4,889
State Water Project	3,126	2,060	3,439	2,394
Other Federal Projects	910	694	912	683
Colorado River	5,176	5,227	4,400	4,400
Local Projects	11,054	8,484	11,073	8,739
Required Environmental Flow	31,372	16,643	31,372	16,643
Reapplied	6,441	5,596	6,449	5,575
Groundwater	12,493	15,784	12,678	16,010
Recycled and Desalted	324	333	415	416
Total (rounded)	**77,900**	**59,640**	**78,080**	**59,750**

TABLE 5-6
CALIFORNIA WATER BUDGET

California Water	1995		2020	
	Average Year	Drought Year	Average Year	Drought Year
Supplies (maf)	77.9	59.6	78.1	59.8
Use (maf)	79.5	64.7	80.5	66.0
Water Shortage (maf)	1.6	5.1	2.4	6.2

Future water shortages produce direct and indirect economic consequences. Direct consequences include costs to residential water users to replace landscaping lost during a drought, costs to businesses that experience water supply shortages, and costs to growers forced to fallow land. Indirect consequences include reduced land values, decisions by businesses not to expand, loss of recreational activities, and loss and/or degradation of environmental resources.

SACRAMENTO RIVER BASIN

In the Sacramento River basin, surface water accounts for about 70 percent of the region's average year water supply, excluding supplies dedicated to environmental purposes. Groundwater provides the remaining supply. During drought years, additional groundwater is pumped to compensate for reduced surface water supplies. The basin has 43 major reservoirs, with a combined storage capacity of almost 16 maf. About half of this surface capacity is contained in Lake Shasta and Lake Oroville. DWR calculates that the Sacramento River basin water budget under average conditions had a shortage of 111,000 acre-feet (af) in 1995 and will have a shortage of 85,000 af in 2020. Under drought conditions, the shortage was 867,000 af in 1995 and will grow to 989,000 af in 2020.

SAN JOAQUIN RIVER BASIN

In the San Joaquin River basin, much of the valley floor receives its water supply from Sierra Nevada reservoirs. The agricultural lands west of the valley trough are mostly served by the CVP. Agricultural lands in the northwest corner of the basin receive their water supply directly from the Delta waterways. Foothill mountain areas obtains their water either directly from streams and lakes or from local storage reservoirs and conveyance facilities. The San Joaquin River basin water budget indicates shortages under average conditions of 239,000 af in 1995 and projects 63,000 af in 2020. Under drought conditions, the budget indicates shortages of 788,000 af in 1995 and 711,000 af in 2020. For 2020, re-operation of Farmington Dam, constructing Montgomery Reservoir, and enlarging Friant Dam could eliminate the average year shortage and reduce the drought year shortage to 658,000 af.

TULARE LAKE BASIN

Pine Flat Lake on the Kings River, Lake Kaweah on the Kaweah River, Success Lake on the Tule River, and Lake Isabella on the Kern River provide water supply, recreation, and flood protection to the region. Under 1995 conditions, these surface water storage systems are the most significant sources of surface water supply for the region. The CVP (which delivers water through the joint State-Federal San Luis Canal, Coalinga Canal, Friant-Kern Canal, and Cross Valley Canal) and the SWP are the other major sources of surface water for the region.

DWR calculated that the Tulare Lake basin water budget had shortages under average conditions of 870,000 af in 1995 and shortages of 1,862,000 af under drought conditions. Projected shortages will be 720,000 af in 2020 under average conditions and 1,851,000 af under drought conditions.

FLOOD MANAGEMENT INFRASTRUCTURE

The Sacramento and San Joaquin River flood management systems have been tested by floods of record and have revealed deficiencies. Operation, repair, and maintenance of these systems will continue on the Federal, State, and local levels. New Corps flood management projects will be cost-shared, and operated and maintained by the non-federal sponsor, in accordance with Federal law. Predicted increases in population and in residential, commercial, and industrial growth, and the long-term trend toward permanent and vegetable crops in the basins will increase the commercial value of resources that are protected by flood management systems.

A number of authorized projects to reduce flood damages in the Central Valley are expected to progress to construction, and several studies are in progress to evaluate potential projects. Projects include the six-phase Sacramento River Flood Control Systems levee reconstruction project, the West Sacramento Project, the American River Flood Control Project (Common Features), Merced County Streams Group project, and Lake Kaweah enlargement project. The studies include the American River Flood Control Project, Yuba River Basin, South Sacramento Streams, Hamilton City, Tehama, West Stanislaus, and Tuolumne River.